POLITECNICO DI TORINO
SECOND SCHOOL OF ARCHITECTURE
Master of Science in Architecture
Honors theses

Damages to a wall plug after the earthquake: analysis and proposals of intervention

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The earthquake that hit L'Aquila makes us think of what has happened and how possible to prevent it.

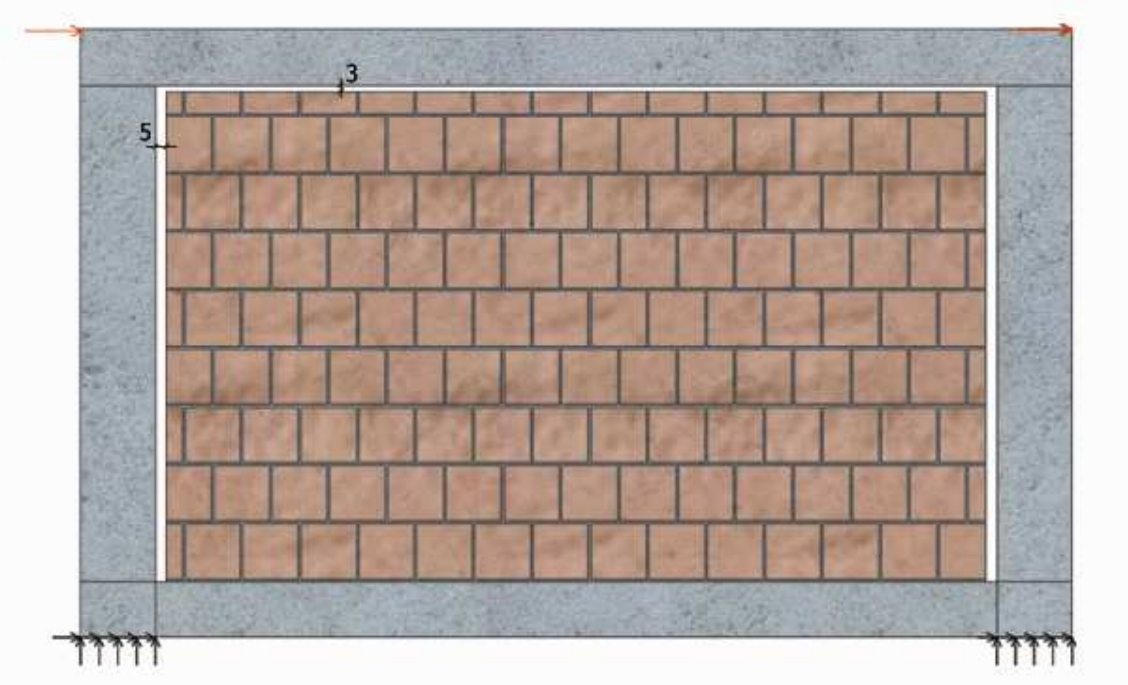
The subject of the topic is very important as on the one hand, it allows us deepening our knowledge in the mentioned field and on the other hand, it allows both to increase the knowledge of building structure and the building materials.

It's very important to remember there is only one way now to prevent the repetition of the disaster-to inspect undamaged buildings.

The buildings were subjected to the multiple structural damage, and I am not only talking about reinforced concrete structure elements but about dry wall partition as well, that were the ones to be subjected to the multiple collapses as to the rigidity of wall-structure connection.

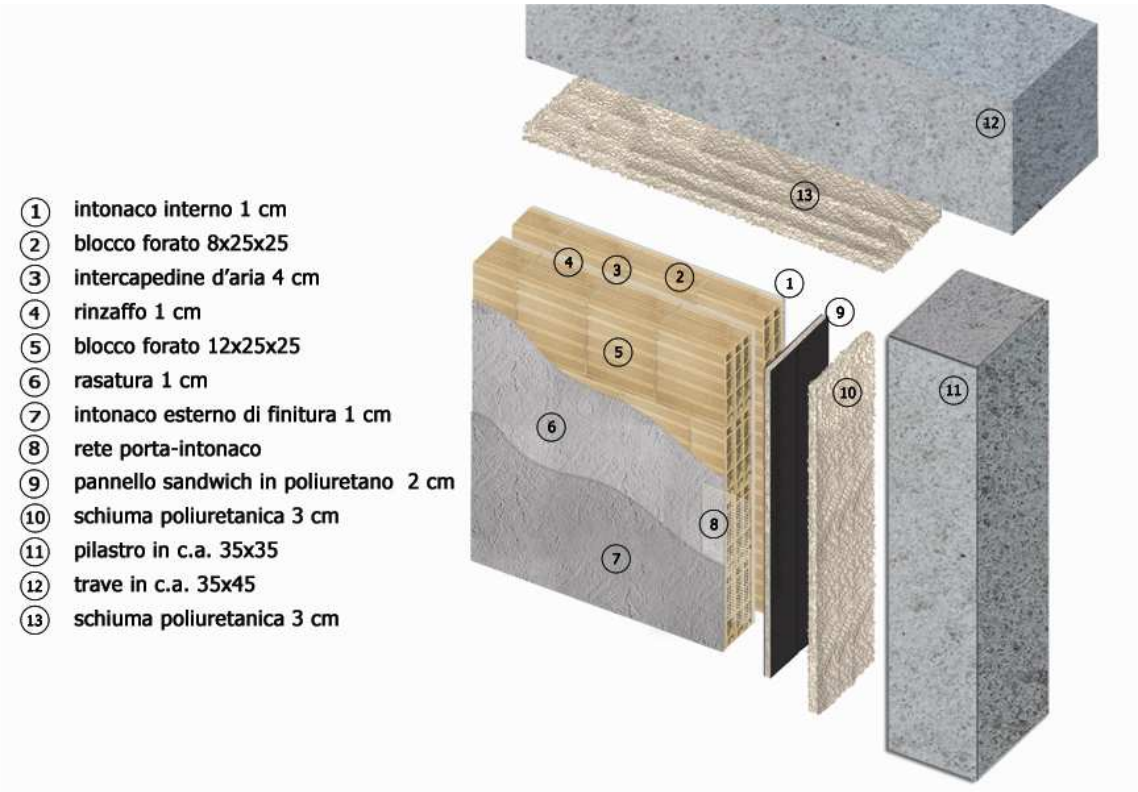
Collapse of the dry wall partition

All above-mentioned makes us think of how to avoid the damages listed.
The main aim of the topic is to find a solution for the undamaged buildings that would: allow decreasing earthquake oscillation effects, whole wall preservation facility, short terms and low cost labor.
The final goal is to keep the wall standing despite the ground oscillation caused by earthquake and to prevent it from fraction and collapse.
While testing the buildings subjected to the earthquake we could discover that steel and reinforced concrete constructions having flexible structure react better to the oscillation, when brick and mortar construction are more rigid.
This it's better to keep the panel more flexible.
Calculating maximum interpolation displacement according to the NTC 2008 gives the results of approximately 3 cm in the worst case.
The solution is to create an interstice on the perimeter of the wall excluding the base for it to remain bound to the inferior slab to prevent the generation of high-tension inside the structure that can cause serious damage of the wall.
The interstice has to be filled up with a material that has lower modules of elasticity comparing to the normal mortar to keep the structure less rigid and have it stand out the earthquake.
The interstice material has to be 20 MPa or less as given by Lusas program calculations.
The interstice we get is going to be 5 cm for the both sides of the dry wall partition while for the advanced part it is going to be 3 cm.



Model of dry wall partition projected with the program Lusas

The cut of brick wall is carried out by machine. The following phase is to glue a polyurethane foam panel to a brick structure to obstruct the holes, after which the remaining interstice is be filled up with polyurethane foam, the materials that is within the limits of E value, as it was previously calculated guarantees a satisfactory adhesion of two materials.



Proposal of intervention on existing building

The advantage of use of the mentioned technique and polyurethane foam is in: short installation time, possibility of using a non-qualified labor, low cost of realization, easy to apply on the old buildings.
We decided to use this type of thermoplastics as it has good compressibility characteristics, material pressing and measurement of the consequent return that is very important in seismic field.
The solution given can be applied for existing structures or as an alternative for the techniques used for new buildings.

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